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(54) Recording of scrambled digital data

(57) A system for transmission and recording of digital data, comprising transmission means 6 adapted to prepare and transmit scrambled digital data, together with at least one encrypted control word and a digital recording device 41 adapted to receive and record the scrambled digital data and encrypted control word on a digital support 43, the digital recording device 41 further

including an access control means 42 adapted to decrypt the control word and thereafter descramble the digital data during playback. The present invention is particularly, but not exclusively, adapted to the transmission of scrambled audio data to be recorded on a mini disc reader 41.

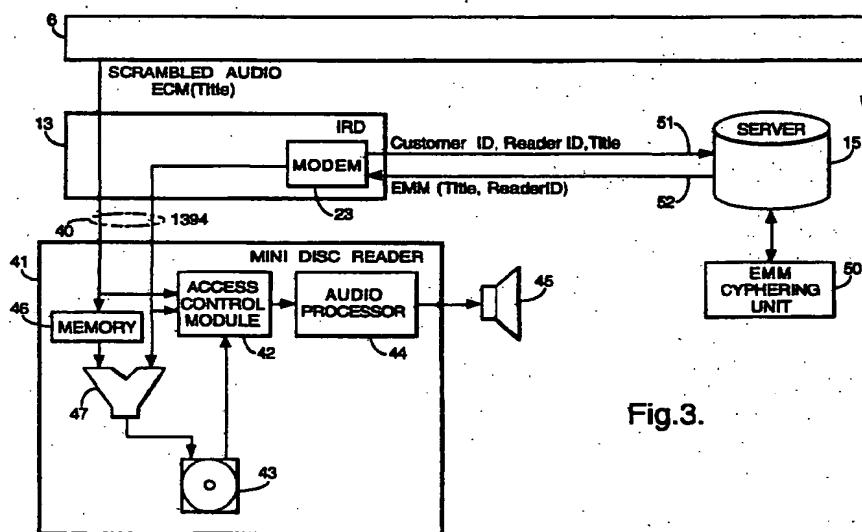


Fig.3.

Description

[0001] The present invention relates to a method and apparatus for transmission and recording of scrambled digital data, for example broadcast audio data.

[0002] Transmission of scrambled or encrypted data is well-known in the field of pay TV systems, where scrambled audiovisual information is broadcast e.g. by satellite to a number of subscribers, each subscriber possessing a decoder or receiver/decoder capable of descrambling the transmitted program for subsequent viewing.

[0003] In a typical system, scrambled digital data is transmitted together with a control word for descrambling the digital data, the control word itself being encrypted by a first key and transmitted in encrypted form, the scrambled digital data and encrypted code word being received by a decoder possessing an equivalent of the first key necessary to decrypt the encrypted control word and thereafter descramble the transmitted data. Usually, the control word changes every 10-15 seconds. A paid-up subscriber will receive on a monthly basis a message including the key necessary to decrypt the encrypted control words so as to permit viewing of the broadcast programs.

[0004] With the advent of digital technology, the quality of the transmitted data has increased many times over. A particular problem associated with digital quality data lies in its ease of reproduction. Where a descrambled program is passed via an analogue link (e.g. the "Peritel" link) for viewing and recording by a standard VCR the quality remains no greater than that associated with a standard analogue cassette recording. The risk that such a recording may be used as a master tape to make pirate copies is thus no greater than with a standard shop-bought analogue cassette.

[0005] By way of contrast, any descrambled digital data passed by a direct digital link to one of the new generation of digital recording devices (for example, a DVHS recorder) will be of the same quality as the originally transmitted program. It may thus be reproduced any number of times without any degradation of image or sound quality. There is therefore a considerable risk that the descrambled data will be used as a master recording to make pirate copies, either further digital copies or even simple analogue VHS copies. There may nevertheless be certain circumstances in which a legitimate user may be permitted to download and record pre-paid audiovisual data, notably audio data (selected extracts from a piece of music, an album or CD etc.).

[0006] It is an object of the present invention to enable such a system to be put in place in a secure manner, so as to permit authorised recording of transmitted digital data, whilst minimising the risk of pirate copies of such recordings being made by unauthorised third parties.

[0007] According to the present invention there is provided a system for transmission and recording of digital data, comprising transmission means adapted to pre-

pare and transmit scrambled digital data together with at least one encrypted control word and a digital recording device adapted to receive and record the scrambled digital data and encrypted control word on a digital support, the digital recording device further including an access control means adapted to decrypt the control word and thereafter descramble the digital data during playback.

[0008] In this way, the present invention permits the free transmission of digital data since the data in question will be transmitted and recorded in scrambled form on the digital support medium, and may only be accessed thereafter in conjunction with the recording device and associated access control module.

[0009] The terms "scrambled" and "encrypted" and "control word" and "key" have been used here and throughout the text for the purpose of clarity of language. However, it will be understood that no fundamental distinction is to be made between "scrambled data" and "encrypted data" or between a "control word" and a "key".

[0010] The access control means may be permanently integrated in the recording device. However, in some embodiments it may be envisaged that the access control means are incorporated in a discrete module, for example as a smart card or SIM card, insertable in the recording device to permit decryption and descrambling of the recorded data upon playback.

[0011] Whilst the recording device may integrate the receiver means needed to receive the transmitted digital data e.g. via a modem link, in one embodiment the system further comprises a separate receiver/decoder adapted to receive the transmitted digital data and encrypted code word and to communicate this information to the recording device for subsequent recordal.

[0012] In this embodiment, the receiver/decoder may be a standard type as known from the field of digital television broadcast and adapted to receive broadcast audio and/or visual data (scrambled and in clear) as well as data sent, for example, via a modem link to the receiver/decoder. The receiver/decoder may also be integrated with other devices such as digital television, DVHS recorder etc.

[0013] Broadly speaking, the system may function in two possible modes of operation; a cyclical transmission mode and a transmission on demand mode. In the case of a cyclical transmission mode, the transmission means is adapted to repetitively transmit the scrambled digital data and encrypted code word.

[0014] In such a mode, the control word for the data is preferably encrypted by a first key associated with the identity of the data being transmitted. For example, in the case where a number of pieces of music are being transmitted in a repeating cycle, the control word or words needed to descramble the data for each recording are encrypted by a key specific to that particular piece of music. The number of control words needed may depend on the length of the piece of music.

[0015] The equivalent of the key needed to decrypt the control word may be communicated to the access control means in a number of ways, for example, simply by transmission "in clear" over a telephone network or the like. Preferably, however, the first key is encrypted by a second key before communication to the access control means.

[0016] In such an embodiment, the system may further comprise a key encryption means adapted to encrypt the equivalent first key by a second key before communication to recording device, the access control means possessing an equivalent of the second key so as to permit the decryption of the first key and, thereafter, the decryption of the control word and subsequent descrambling of the transmitted data.

[0017] The key encryption means may be integral with the transmission means and the associated circuitry for scrambling the transmission etc. However, it may equally be associated with a separate database and server containing a list of keys associated with each access control means and recording device.

[0018] In the case where the system comprises a receiver/decoder unit, the receiver/decoder unit may be adapted to request a first key from the key encryption means, the key encryption means thereafter transmitting the encrypted first key to the receiver/decoder for subsequent communication to the recording device and access control module.

[0019] For example, the key encryption means may respond to a request received from the receiver/decoder via a modem channel by returning information on this channel. Alternatively, the information may be communicated to the transmission means for subsequent transmission, for example, in a broadcast transmission.

[0020] The above cyclical transmission embodiments have been discussed in particular in relation to systems in which the key used to encrypt the control word is directly associated with the identity of the data (e.g. the particular song or piece of music) transmitted.

[0021] In an alternative embodiment, the same first key is used to encrypt the control word or words associated with a plurality of sets of data. For example, all pieces transmitted during a particular period of time, such as during a month's subscription, may use the same first encryption key to encrypt control word data.

[0022] Similarly, whilst the first key is normally sent in response to a request from a user, in one embodiment the first key is repetitively transmitted by the transmission means in a message encrypted by a second key.

[0023] The verification that the user or subscriber has sufficient rights to receive and record, for example, a month's worth of data may be handled upstream at the transmission. Only those subscribers having paid the necessary subscription will receive the key for that month, as encrypted by their personalised second key and sent by the transmission means.

[0024] In addition, in some embodiments, the access

control module may further include a credit means for monitoring the number of recordings made by the recorder, for example, during a month's worth of credit. In this case, a number of credits may be communicated together with the first key information to the recorder device each month, each recording resulting in the reduction of a credit held by the recording device.

[0025] The above embodiments have been discussed in relation to a cyclical mode of transmission. In an alternative on-demand mode, the transmission means responds to a real-time request to transmit the scrambled digital data and encrypted control word.

[0026] Whilst being more complicated to manage in terms of the received requests, the on-demand embodiment may permit a simplification of the encryption process. In particular, in one embodiment, the control word is directly encrypted by a first key, the access control means possessing an equivalent of this key to permit the decryption of the control word and subsequent descrambling of the data.

[0027] The real-time request may be communicated to the transmission means by a receiver/decoder connected to the recording device. Alternatively, a request may be made by telephone, minitel etc.

[0028] The transmission means may be adapted to transmit data to the recorder via any number of communication channels, for example, via a fixed telecommunications network. However, the invention is particularly applicable to broadcast transmission of primarily audio-visual or multimedia digital data, notably audio data. The present invention may also be used in conjunction with many types of digital recording devices.

[0029] In one preferred embodiment, the transmission means is adapted to transmit digital audio data. In such an embodiment, the recording device may conveniently comprise a mini disc recorder adapted to include access control means as described above.

[0030] The present invention equally extends to a recording device for use in a system as described above and a method of transmission and recording of scrambled data.

[0031] Other general and preferred features of the first and second aspects of the invention will be apparent from the description of the various exemplary embodiments. In this regard, there will now be described, by way of example only, a number of embodiments of the present invention, with reference to the attached figures, in which:

Figure 1 shows an overview of a digital television system adaptable for use in the present invention;

Figure 2 shows the elements of the receiver/decoder of Figure 1;

Figure 3 shows a first embodiment of the invention including a recording device for recording transmitted scrambled data;

Figure 4 shows the recorded data associated with the embodiment of Figure 3;

Figure 5 shows a second embodiment of the invention adapted to use the principle of a series of pre-paid tokens;

Figure 6 shows the recorded data associated with the embodiment of Figure 5;

Figure 7 shows a third embodiment of the embodiment in which data is supplied on demand; and

Figure 8 shows the recorded data associated with the embodiment of Figure 7.

[0032] In the embodiments of Figures 3 to 8, the present invention will be discussed in relation to the broadcast transmission of scrambled data and its subsequent recordal. A digital television system and decoder for use in such a context will now be described in relation to Figures 1 and 2.

[0033] An overview of a digital television system 1 according to the present invention is shown in Figure 1. The invention includes a mostly conventional digital television system 2 that uses the known MPEG-2 compression system to transmit compressed digital signals. In more detail, MPEG-2 compressor 3 in a broadcast centre receives a digital signal stream (typically a stream of video signals). The compressor 3 is connected to a multiplexer and scrambler 4 by linkage 5.

[0034] The multiplexer 4 receives a plurality of further input signals, assembles the transport stream and transmits compressed digital signals to a transmitter 6 of the broadcast centre via linkage 7, which can of course take a wide variety of forms including telecommunications links. The transmitter 6 transmits electromagnetic signals via uplink 8 towards a satellite transponder 9, where they are electronically processed and broadcast via notional downlink 10 to earth receiver 12, conventionally in the form of a dish owned or rented by the end user. The signals received by receiver 12 are transmitted to an integrated receiver/decoder 13 owned or rented by the end user and connected to the end user's television set 14. The receiver/decoder 13 decodes the compressed MPEG-2 signal into a television signal for the television set 14.

[0035] Other transport channels for transmission of the data are of course possible, such as terrestrial broadcast, cable transmission, combined satellite/cable links, telephone networks etc.

[0036] In a multichannel system, the multiplexer 4 handles audio and video information received from a number of parallel sources and interacts with the transmitter 6 to broadcast the information along a corresponding number of channels. In addition to audiovisual information, messages or applications or any other sort of digital data may be introduced in some or all of these

channels interlaced with the transmitted digital audio and video information.

[0037] A conditional access system 15 is connected to the multiplexer 4 and the receiver/decoder 13, and is located partly in the broadcast centre and partly in the decoder. It enables the end user to access digital television broadcasts from one or more broadcast suppliers. A smartcard, capable of deciphering messages relating to commercial offers (that is, one or several television programmes sold by the broadcast supplier), can be inserted into the receiver/decoder 13. Using the decoder 13 and smartcard, the end user may purchase commercial offers in either a subscription mode or a pay-per-view mode.

[0038] As mentioned above, programmes transmitted by the system are scrambled at the multiplexer 4, the conditions and encryption keys applied to a given transmission being determined by the access control system 15. Transmission of scrambled data in this way is well known in the field of pay TV systems. Typically, scrambled data is transmitted together with a control word for descrambling of the data, the control word itself being encrypted by a so-called exploitation key and transmitted in encrypted form in an ECM (Entitlement Control Message).

[0039] The scrambled data and encrypted control word are then received by the decoder 13 having access to an equivalent of the exploitation key stored on a smart card inserted in the decoder to decrypt the encrypted ECM and control word and thereafter descramble the transmitted data. A paid-up subscriber will receive, for example, in a broadcast monthly EMM (Entitlement Management Message) the exploitation key necessary to decrypt the encrypted control word so as to permit viewing of the transmission.

[0040] An interactive system 16, also connected to the multiplexer 4 and the receiver/decoder 13 and again located partly in the broadcast centre and partly in the decoder, enables the end user to interact with various applications via a modem back channel 17. The modem back channel may also be used for communications used in the conditional access system 15. An interactive system may be used, for example, to enable the viewer to communicate immediately with the transmission centre to demand authorisation to watch a particular event, download an application etc.

[0041] Referring to Figure 2, the elements of the receiver/decoder 13 or set-top box adapted to be used in the present invention will now be described. The elements shown in this figure will be described in terms of functional blocks.

[0042] The decoder 13 comprises a central processor 20 including associated memory elements and adapted to receive input data from a serial interface 21, a parallel interface 22, a modem 23 (connected to the modem back channel 17 of Fig 1), and switch contacts 24 on the front panel of the decoder.

[0043] The decoder is additionally adapted to receive

inputs from an infra-red remote control 25 via a control unit 26 and also possesses two smartcard readers 27, 28 adapted to read bank or subscription smartcards 29, 30 respectively. The subscription smartcard reader 28 engages with an inserted subscription card 30 and with a conditional access unit 29 to supply the necessary control word to a demultiplexer/descrambler 30 to enable the encrypted broadcast signal to be descrambled. The decoder also includes a conventional tuner 31 and demodulator 32 to receive and demodulate the satellite transmission before being filtered and demultiplexed by the unit 30.

[0044] Processing of data within the decoder is generally handled by the central processor 20. The software architecture of the central processor may correspond to that used in a known decoder and will not be described here in any detail. It may be based, for example, on a virtual machine interacting via an interface layer with a lower level operating system implemented in the hardware components of the decoder. In terms of the hardware architecture, the decoder will be equipped with a processor, memory elements such as ROM, RAM, FLASH etc. as in known decoders.

[0045] In the case of received audio and video signals, and as will be described in more detail below, the MPEG packets containing these signals will be demultiplexed and filtered so as to pass real time audio and video data in the form of a packetised elementary stream (PES) of audio and video data to dedicated audio and video processors or decoders 33, 34. The converted output from the audio processor 33 passes to a preamplifier 35 and thereafter via the audio output of the receiver/decoder.

[0046] The converted output from the video processor 34 passes via a graphic processor 36 and PAL/SECAM encoder 37 to the video output of the receiver/decoder.

[0047] The graphic processor 36 additionally receives graphic data for display (such as generated images etc) from the central processor 20 and combines this information with information received from the video processor 34 to generate a screen display combining moving images together with overlaid text or other images.

[0048] In the case of received teletext and/or subtitle data, the conversion of the real time PES data to generate the appropriate images may also be handled by dedicated processors. However, in most conventional systems, this is handled by the general processor 20.

[0049] The system described above in relation to Figures 1 and 2 has been set out in relation to the broadcast and reception of television data. As will now be described, the system is equally adaptable to the broadcast, for example, of exclusively audio data, the decoder functioning in this case as a digital radio receiver.

[0050] Whilst the following description concentrates on the reception and recordal of audio data, the same principles may be easily applied to audiovisual or other digital multimedia data transmitted and received for example via the decoder. Similarly, whilst the embodiment will be discussed in particular in relation to a mini

disc reader/recorder device, the same principles may be applied to DVHS readers, CD ROM devices, etc. The receiver/decoder may itself integrate such recording devices.

- 5 [0051] Referring now to Figure 3, the decoder 13 is connected, via a IEEE 1394 bus 40 to a digital recording device 41, such as a mini disc reader, adapted to receive and record audio information received by the decoder 13. The device 41 is further adapted to include an access control module 42, the operation of which will be described in detail below. This access control module 42 corresponds in many ways to the smartcard and conditional access module 29 normally used to descramble broadcast television transmissions. Specifically, encrypted audio data recorded on a digital recording support in the form of a mini disc 43 is descrambled by the access control module 42 and passed to an audio processor 44 before eventual output to a pair of headphones or loudspeaker 45.
- 10 [0052] In view of the reduced data flow of audio data in comparison with a full audiovisual television signal, the access control module 42 can be realised in the form of a single chip containing all the elements necessary to receive a scrambled signal and output a clear signal, including the necessary cryptographic key or keys (see below) and associated descrambling circuitry. This chip may be integrated within the recording device 41 or may be embodied in a SIM card or similar insertable in a slot in the device.
- 15 [0053] In this embodiment, a particular title or piece of music (a song, set of songs, etc.) available to be recorded is scrambled prior to transmission by a control word. In the same manner as for a television broadcast, scrambling is carried out using a control word which changes every 10-15 seconds or so. Each control word (and other data, if desired) is encrypted using an encryption key Kt associated with the identity of the piece of music, for example the title of the song concerned, so as to form a characteristic ECM message.
- 20 [0054] The audio data and associated ECM messages are sent cyclically by the transmitter 6. That is, this data is broadcast continuously (or at least at regular intervals) to a field of decoders. In the event that a user decides to purchase this title, for example, by selecting the title from a menu of available titles using the decoder remote control, the decoder 13 sends a message 51 to the access control server 15 and ciphering unit 50. The message includes information relating to the title of the piece of music, the identity of the recording device 41 that will be used to record the data and the identity of the customer's decoder 13.
- 25 [0055] As described above, the ECM containing the control word needed to descramble the audio information is encrypted using a key associated with the title of the piece of music. The ciphering unit 50 possesses the equivalent of the key Kt needed to decrypt the ECM message as well as a key Ki associated with the identity of the mini disc reader and, more particularly, with the

access control module 42 which possesses the equivalent decryption key. The key K_t (and other data, if desired) is encrypted by the key K_i and the resulting EMM message 52 sent via the server 52 to the decoder 13.

[0056] The communication of identity of the decoder 13 to the server 15 is not needed in the encryption/decryption process but may be used in the eventual billing to the customer of his purchase of his piece of music.

[0057] The EMM and the data to be recorded (as downloaded by the decoder from the MPEG broadcast stream) are sent via the bus 1394 to the mini disc/reader recorder 41. As will be appreciated the EMM message, the data to be recorded and the associated ECM are all sent in encrypted or scrambled form on the bus 40 and are unreadable to any third party not possessing the keys K_t , K_i .

[0058] The data transmitted to the mini disc reader 41 are thereafter combined at 47 and recorded on the disc 43 in the form shown in Figure 4. In particular, each recording comprises a header 60 containing general information regarding the recording, an EMM section 61 containing the EMM, and one or more sections 62 containing the scrambled audio data segments each with the associated ECM containing the control word necessary to scramble the data.

[0059] As mentioned above, in this embodiment, the piece of music to be recorded is transmitted continuously in a transmission cycle. In order to enable the decoder 13 to start downloading the piece at any time once it has been selected by the user, the mini disc device 41 may additionally be supplied with a buffer type memory 46. The individual segments making up the piece of music may be downloaded in any order (for example, starting in the middle of the piece) and thereafter re-arranged in the correct order to be recorded on the disc 43 in the correct order together with the EMM message as shown in Figure 4.

[0060] When replaying the recording, the access control module will decrypt the EMM, using its equivalent of the key K_i , and thus obtain the equivalent of the key K_t associated with the encryption of the ECMs. Each ECM is then decrypted with the equivalent key K_t to obtain the control word needed to scramble that segment of audio data. The algorithms used to generate the keys K_t , K_i and their equivalent may correspond to any known symmetric algorithm such as, for example, DES. Alternatively, in some cases public/private key pairs such as are known from the RSA algorithm may be used.

[0061] As mentioned above, in view of the relatively low data rate associated with audio information, all these operations, including the descrambling itself, may be carried out within a single chip. Alternatively, some or part of the process may be carried out separately. For example, the access control module may simply supply a decrypted control word stream in association with the

scrambled audio data to a separate descrambler unit.

[0062] The use of a control word adapted to change every 10-15 seconds is a concept known from the field of television broadcasts. In the present case and given that the average length of a scrambled piece of music may be only 3-4 minutes, the structure may be simplified, for example, to have only a single control word and ECM for any given piece of music.

[0063] It is even possible to imagine a situation in which the use of an EMM is dispensed with and the server 15 sends in clear the key K_t necessary to decrypt a given piece of music in response to a request from the decoder. For obvious reasons, the security of such a system would be extremely low, since all information needed to decrypt a piece of music would be present in clear in transmission or as recorded on the disc 43, and such an embodiment would deter only the most basic level of fraud.

[0064] As described, an EMM is requested by a command from the decoder 13 to the server 15 and unit 15 and returned by the same modem channel. As will be appreciated, other communication channels may be used. For example, the user may command an EMM via the telephone or Minitel, and the EMM may be generated and sent, for example, in the MPEG flow via the satellite link.

[0065] The embodiment of Figures 3 and 4 relies on the principle of association of a key K_t with a particular set of data or piece of music and the communication of this key for example in a specific EMM generated in response to a request. Figures 5 and 6 show an alternative embodiment, again using the cyclical transmission of the audio data, but based on the principle of subscription together with the use of a number of predetermined credits.

[0066] In this embodiment, the connection between the decoder 13 and the server 15 and unit 30 is not shown, since the mini disc reader 41 receives (upon connection to the decoder 13) a regularly transmitted EMM message containing the exploitation key K_e needed to decode that month's ECMs (i.e. the ECMs associated with all the pieces transmitted during that month) together with a number of credits.

[0067] In particular, the key K_e is encrypted by the key K_i associated with a particular reader 41 to create an EMM. Upon connection to the decoder 13, the EMM message for that month and associated with that reader 41 is recorded on the disk 43 together with the date and ECM messages relating to the chosen piece of music. See Figure 6, where the numeral 63 designates the EMM message recorded in this embodiment.

[0068] The transmission of an EMM assigned to a particular reader will of course depend on the user having taken the necessary steps to purchase the rights to download data for recordal. This may be handled, for example, in a subscription system of the type described in relation to Figures 1 and 2, where the access control system 15 manages the list of subscribers or, more spe-

cifically, a list of decoders designated to receive certain broadcast programs.

[0069] Since it is envisaged that many titles or pieces of music will be sent during a given month, and that a user may not have unlimited rights to record all titles, it may be necessary to use a credit system to monitor the number of recordings that may be carried out. In such a case, the device 41 will record in the access control module 42 information regarding the recording in question, for example, data stocked in one or more ECMs transmitted with the title. Using an EEPROM memory of 4000 bytes, the access control module 42 can stock information relating to up to 1000 recordings.

[0070] Making a note of each time a recording is made enables the access control module to ensure that the number of recordings made per month does not exceed the number of credits transmitted in that month's EMM. Credits transmitted with EMMs may be carried over from one month to the next.

[0071] Upon replaying the recording, the access control module 42 decrypts the EMM using its equivalent key K_i , obtains the key K_e associated with the ECM for recordings in that month and thereafter decrypts individual ECM messages to obtain the control word to descramble each segment.

[0072] Price information may equally be included in the ECM, different priced recordings being offered in the same month. Again, this information may be recorded and used by the access control module 42 to manage the number of recordings that may be made by a given user.

[0073] Whilst this embodiment avoids the need to generate in real-time a specific EMM in response to a user request, the memory space requirements of the access control module 42 increase greatly to track the recordings purchased. In an alternative realisation, this could be handled within the decoder 13. If so, two sets of keys would need to be used; one to encrypt/decrypt EMM transmissions from the transmitter 6 to decoder 13, and one to re-encrypt EMM messages for subsequent routing to and decryption by the recorder device 41.

[0074] Referring now to Figures 7 and 8, a simpler embodiment of the present invention will now be described. In this embodiment, a user who wishes to download and record a piece of music sends a request including the disc reader ID, the title of the piece of music and the decoder ID to a server 15. This request may be effected, for example, via the modem of the decoder 23. Equally, a request may be sent using a phone 48 or minitel 49.

[0075] Unlike previous embodiments, the piece of music is not broadcast cyclically but, instead, is only broadcast in response to an instruction from the server 15 to the transmitter 6. The transmitter scrambles the data prior to transmission with a changing control word and encrypts each control word (and other data, if desired) with a key K_i associated with the reader ID to

prepare a user specific ECM. As before, the decoder ID is merely used for the purpose of billing the user.

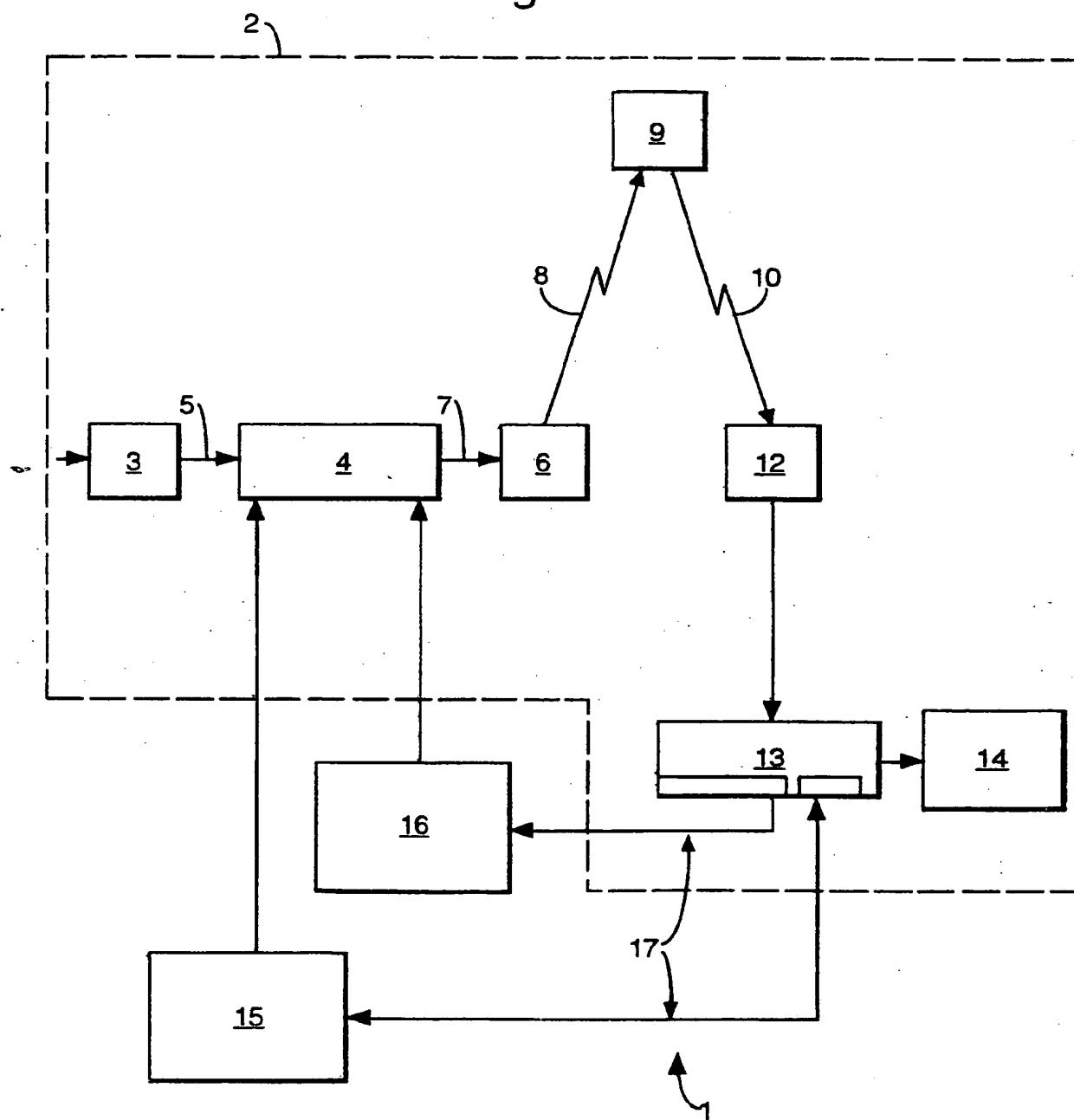
[0076] In this embodiment, the information to be recorded on the disk 43 is considerably reduced, as shown in Figure 8, and comprises simply a header 60 and a series of ECMs 64. Upon reading a recording, the access control module 42 uses its equivalent of the key K_i to decode each ECM and to obtain the control word needed to decode each data segment associated with the ECM.

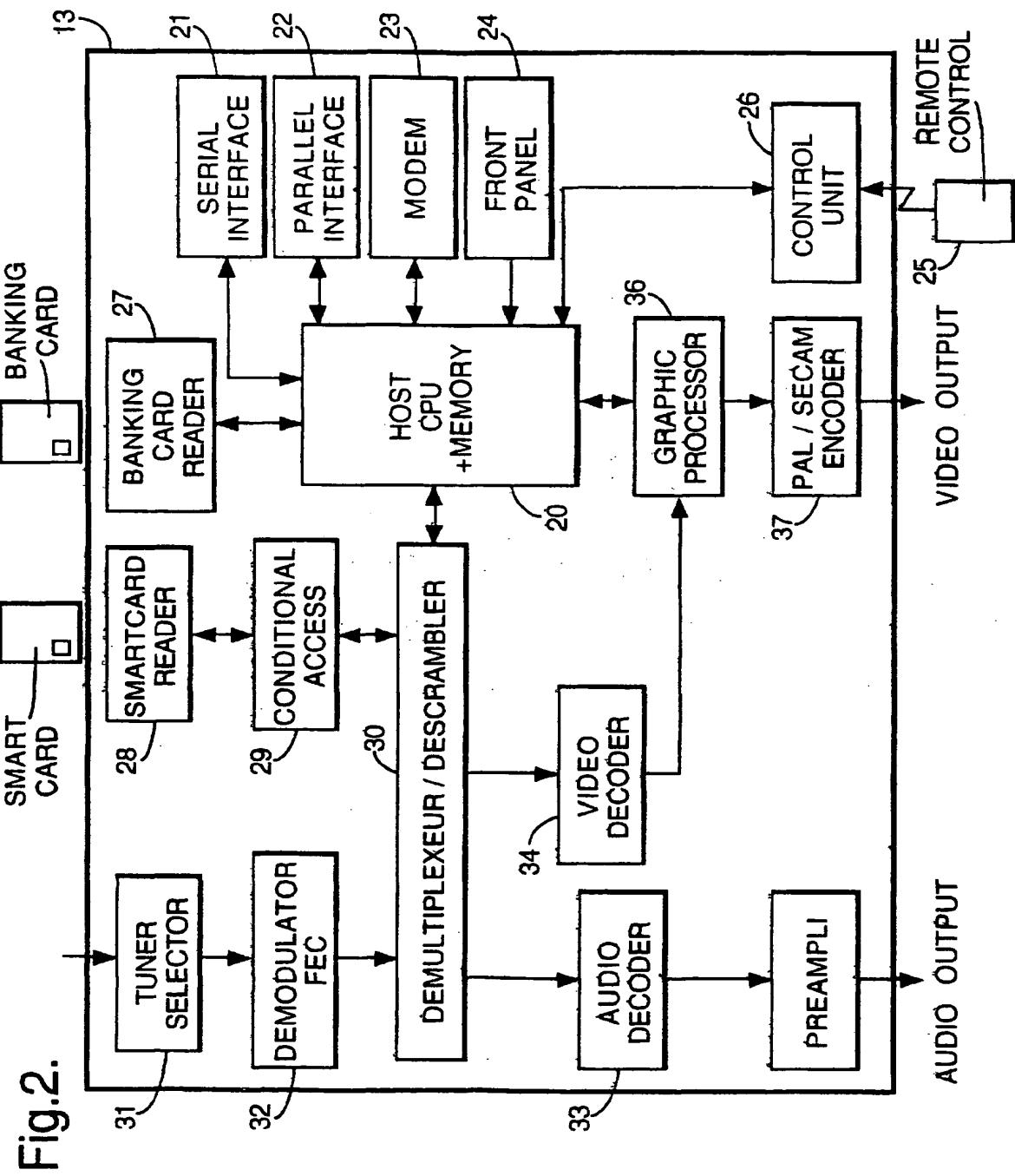
Claims

1. A system for transmission and recording of digital data, comprising transmission means adapted to prepare and transmit scrambled digital data together with at least one encrypted control word and a digital recording device adapted to receive and record the scrambled digital data and encrypted control word on a digital support, the digital recording device further including an access control means adapted to decrypt the control word and thereafter descramble the digital data during playback.
2. A system as claimed in claim 1 in which the access control means are incorporated in a discrete module insertable in the recording device to permit decryption and descrambling of the recorded data upon playback.
3. A system as claimed in claim 1 or 2 further comprising a separate receiver/decoder adapted to receive the transmitted digital data and encrypted code word and to communicate this information to the recording device for subsequent recordal.
4. A system as claimed in any preceding claim in which the transmission means is adapted to repetitively transmit the scrambled digital data and encrypted code word.
5. A system as claimed in any preceding claim in which the control word for the data is encrypted by a first key associated with the identity of the data being transmitted.
6. A system as claimed in claim 5 in which the first key is encrypted by a second key before communication to the access control means.
7. A system as claimed in claim 5 or 6 further comprising a key encryption means adapted to encrypt the equivalent first key by a second key before communication to recording device, the access control means possessing an equivalent of the second key so as to permit the decryption of the first key and, thereafter, the decryption of the control word and

- subsequent descrambling of the transmitted data.
8. A system as claimed in claim 7, further comprising a receiver/decoder unit adapted to request a first key from the key encryption means, the key encryption means thereafter transmitting the encrypted first key to the receiver/decoder for subsequent communication to the recording device and access control module. 5
9. A system as claimed in any preceding claim in which the same first key is used to encrypt the control word or words associated with a plurality of sets of data. 10
10. A system as claimed in any preceding claim in which the first key is repetitively transmitted by the transmission means in a message encrypted by a second key. 15
11. A system as claimed in any preceding claim, the access control module comprising a credit means for monitoring the number of recordings made by the recorder and in which a number of credits are communicated to the access control module together with the encrypted first key. 20 25
12. A system as claimed in any of claims 1 to 3 in which the transmission means responds to a real-time request to transmit the scrambled digital data and encrypted control word. 30
13. A system as claimed in claim 13 in which the control word is directly encrypted by a first key, the access control means possessing an equivalent of this key to permit the decryption of the control word and subsequent descrambling of the data. 35
14. A system as claimed in any preceding claim in which the transmission means is adapted to transmit audio data. 40
15. A system as claimed in claim 14 in which the recording device comprises a mini disc recorder adapted to include access control means. 45
16. A recording device for use in the system as claimed in any preceding claim, adapted to record scrambled data and an associated encrypted control word and comprising an access control means adapted to decrypt the recorded control word and descramble recorded scrambled data upon playback. 50
17. A method of transmission and recordal of digital data in which a transmission means prepares and transmits digital data together with at least one control word, the transmitted scrambled data and encrypted control word being recorded by a digital 55
- recording device, the digital recording device comprising an access control means acting to decrypt the control word and thereafter descramble the digital data during playback.

Fig.1.





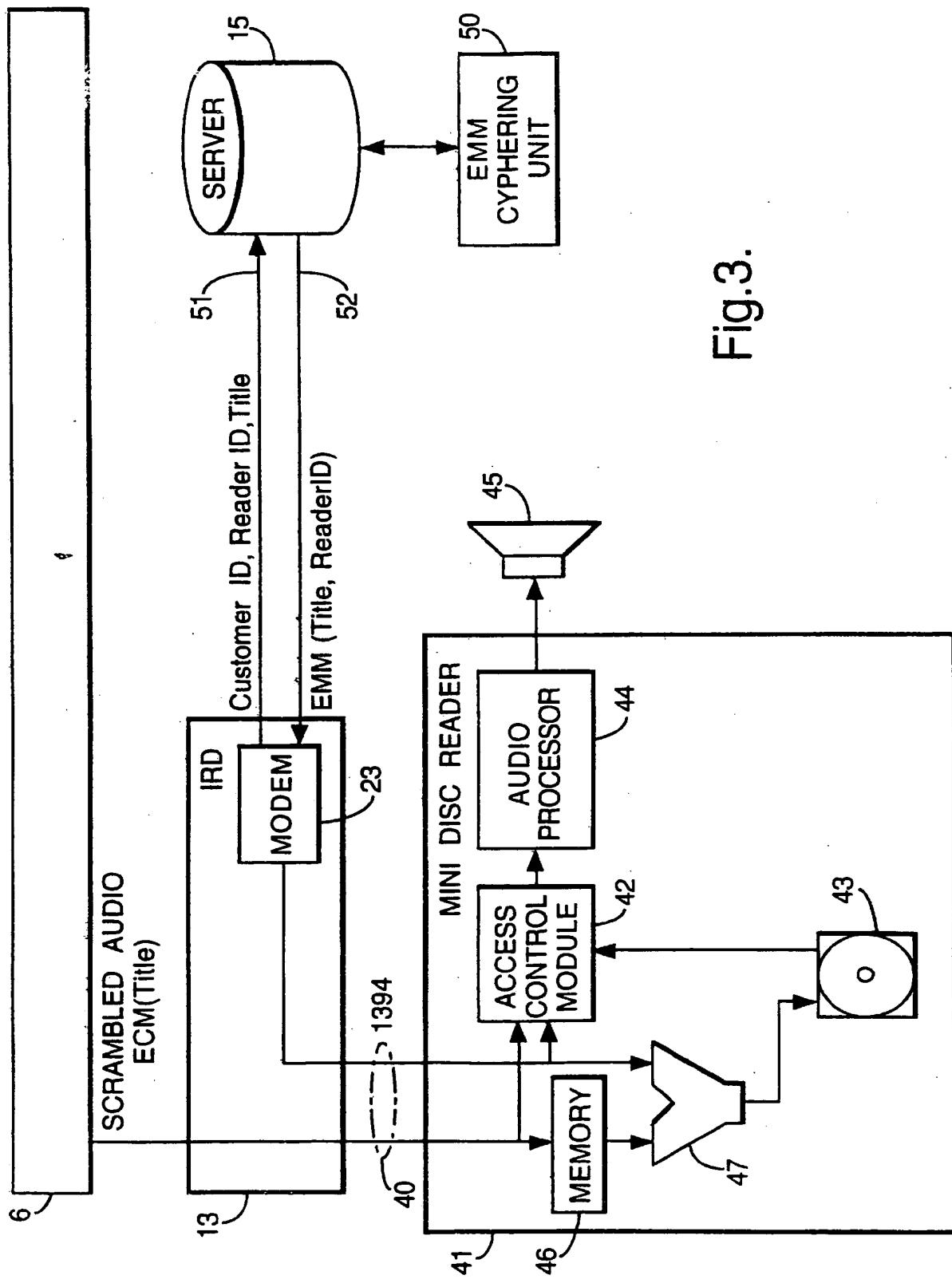


Fig.3.

Fig.4.

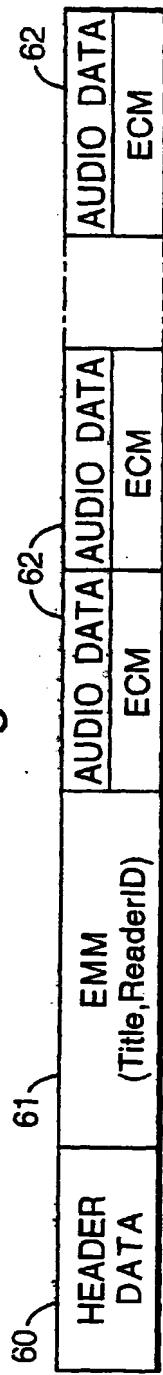


Fig.6.

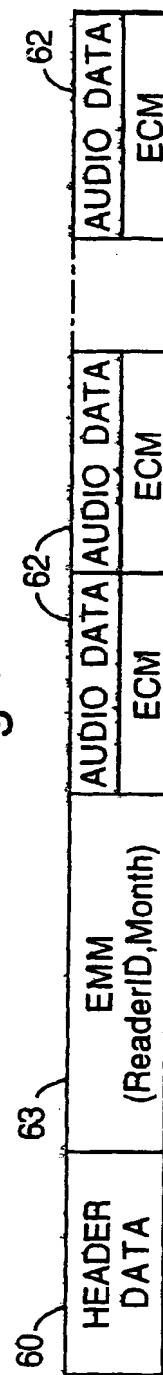


Fig.8.

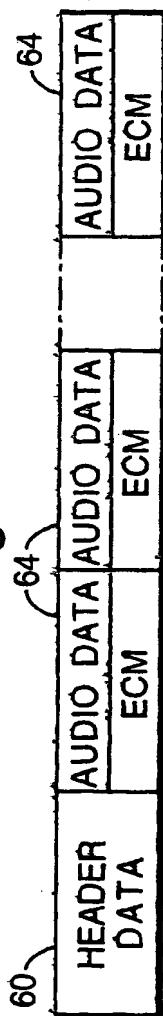
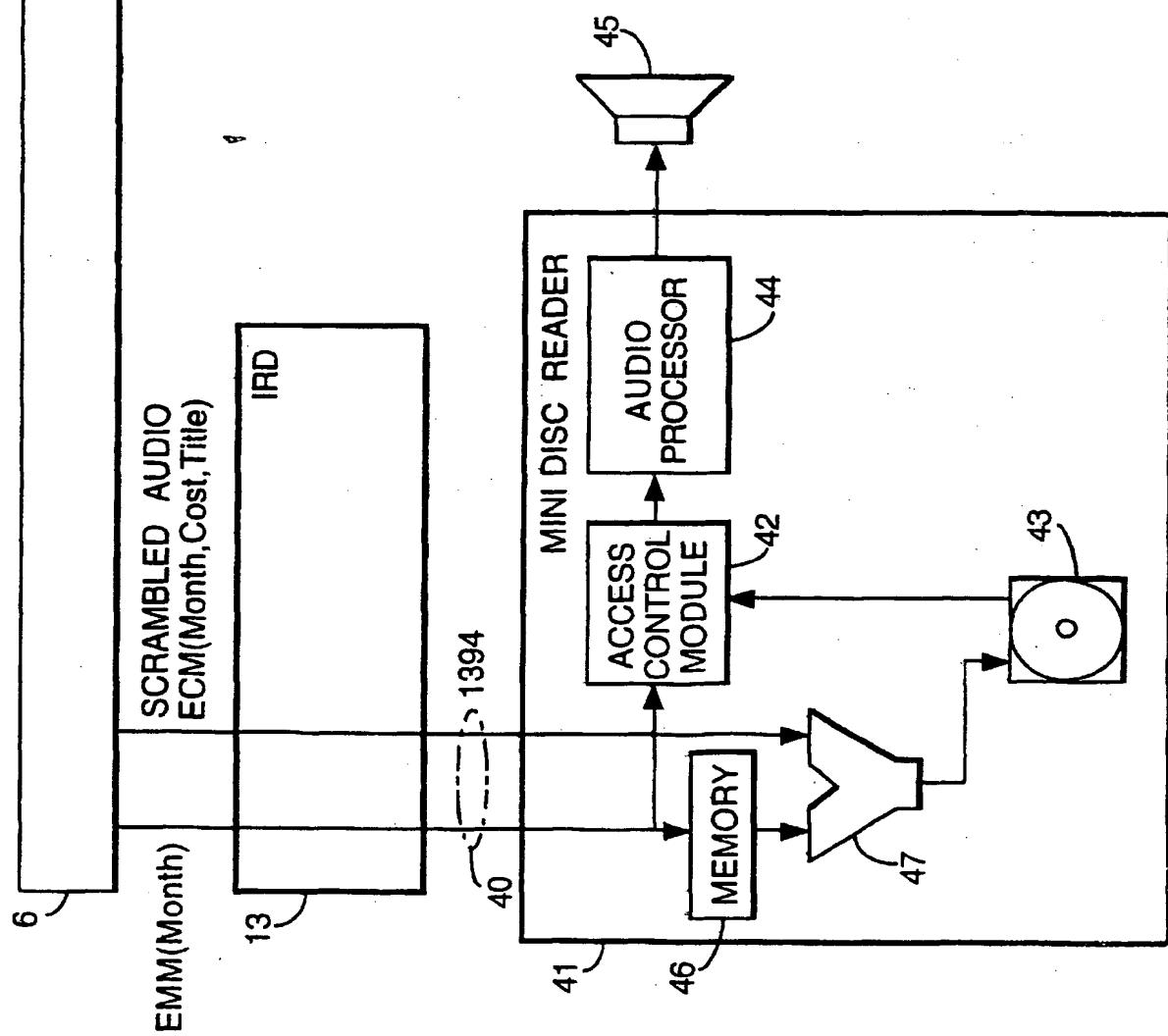


Fig.5.



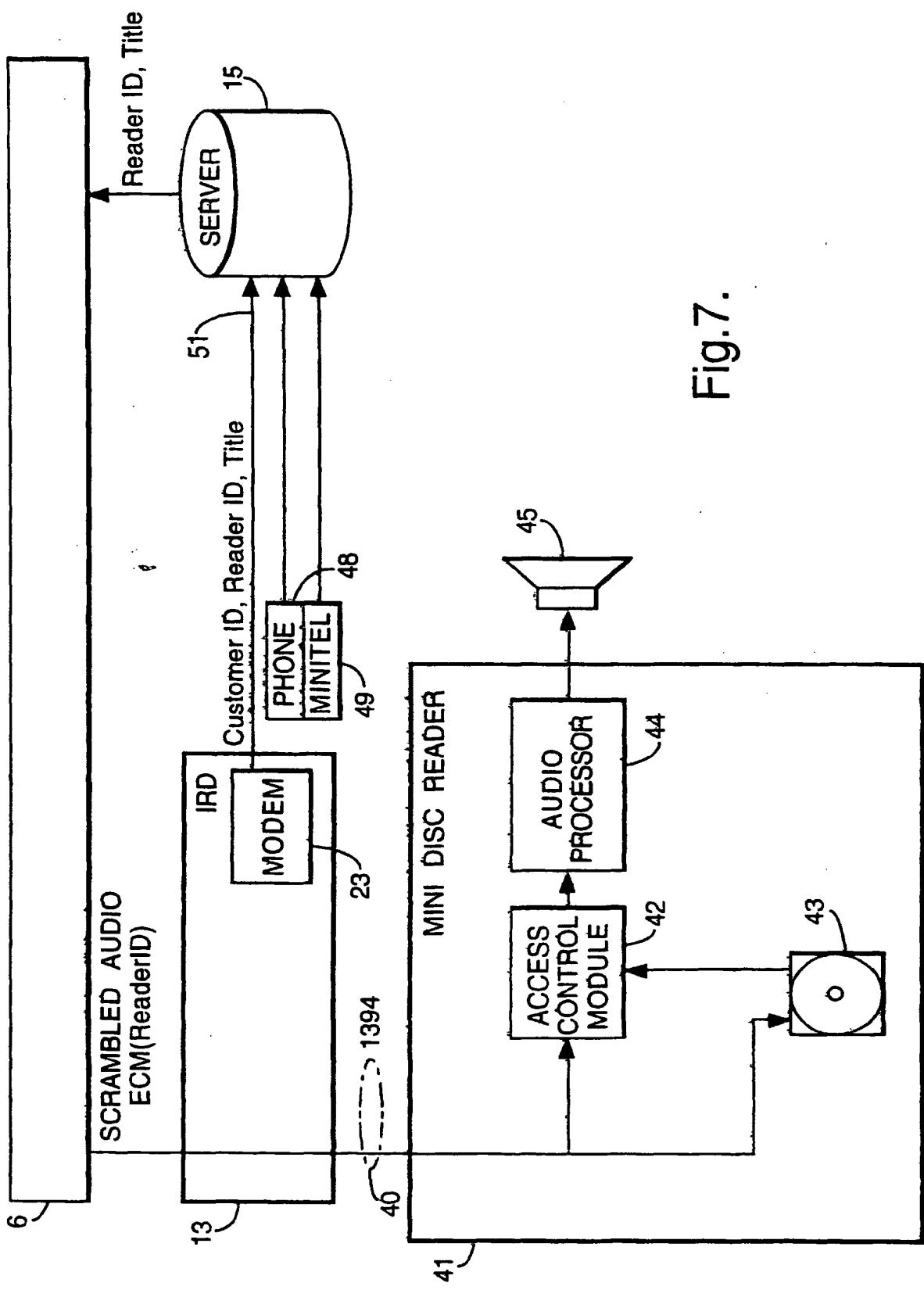


Fig.7.



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 98 40 0344

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	EP 0 763 936 A (LG ELECTRONICS INC) 19 March 1997 * page 4, column 6, line 2 - page 5, column 8, line 29 * * page 6, column 9, line 6 - page 7, column 11, line 43 * * page 10, column 18, line 39 - page 11, column 19, line 47 * * figures 5-26 *	1-11, 14, 16, 17	H04L9/00 H04N5/913 H04N7/16
X	WO 97 49238 A (GOTO KOICHI ; INOUE HAJIME (US); LEE CHUEN CHIEN (US); SONY ELECTRO) 24 December 1997 * page 9, line 33 - page 11, line 10 * * page 14, line 11 - page 17, line 33 * * page 19, line 13 - page 21, line 36 * * page 23, line 6 - line 29 * * page 25, line 3 - line 30 * * figures 1-4 *	1-13, 16, 17	
X	EP 0 678 851 A (BRUGGER ROLF) 25 October 1995 * page 4, column 5, line 23 - page 5, column 7, line 49 * * page 5, column 8, line 37 - line 49 *	1-3, 12, 14, 15	TECHNICAL FIELDS SEARCHED (Int.Cl.6) H04N
The present search report has been drawn up for all claims			
Place of search	Date of completion of the search	Examiner	
THE HAGUE	1 July 1998	Van der Zaal, R	
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